

# General characteristics

- **Healthcare-associated infection (HAI)**

- this infections occur wherever patient care is provided (hospitals, clinics, long-term care facilities...), it is associated with healthcare delivery

- **Hospital – acquired infection**

- definition includes infections developed in hospitals among patients and also occupational infections among staff of the facility

# General characteristics

**Nosocomial infection (NI)** can be defined as:

- An infection **occurring in a patient in a hospital** in whom the infection was not present or incubating at the time of admission (patient was admitted for a reason other than that infection).
- Infections occurring **more than 48 hours** after admission are usually considered nosocomial. This includes infections acquired in the hospital but appearing after discharge.
- During hospitalization, patients can become colonized with organisms foreign to their normal body flora. Colonization is defined as the persistent presence of an organism in the host, without alteration in body function.

# General characteristics

- **Specific NI**

- occur due to special mode of transmission only in health-care facility (e.g. ventilator-associated pneumonia, surgical site infection)
- often caused by resistant nosocomial strains of microorganisms with difficult treatment and worse prognosis

- **Nonspecific NI**

- reflect the current epidemiologic situation in a community and can be acquired anywhere outside the hospital (e.g. flu)
- treatment is less difficult – the causative agents are usually susceptible to antibiotics

# Etiology of NI

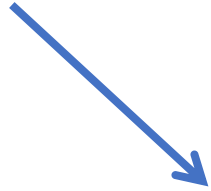
- **Bacteria** – most common (90%) nosocomial pathogens
  - Gram-negative bacteria: 67 %  
*e.g. E. coli, Proteus, Klebsiella, Enterobacter, Pseudomonas spp.*
  - Gram-positive bacteria: 33%  
*e.g. Staphylococci, Streptococci, Enterococci...*
- **Viruses**  
*e.g. hepatitis B and C viruses, rotavirus, adenovirus, SARS-CoV-2*
- **Fungi**  
*e.g. Candida albicans, Aspergillus spp.*

# Nosocomial infection sites

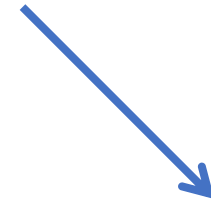
- The four **most common sites** are:
  - urinary tract infection
  - surgical site infection
  - pneumonia
  - primary bloodstream infection
- Two special types
  - neonatal sepsis
  - *Clostridium difficile* infection
- Other potential sites of infection:
  - e.g. skin and soft tissue infections, gastrointestinal infections, eye infections

# Principle of infection spread

**source of infection**



**routes of transmission**



**susceptible host**

# Source of NI

- **Patients** – ill or carriers
- **Staff** - carriers
- **Visitors** - can transmit microbes from the community to patients
- **Animals** – indirectly in poor sanitation conditions

# Routes of transmission

- **endogenous infection**

- infection may be caused by the patient's own flora because of transmission to sites outside the natural habitat

- **exogenous cross-infection (person-to-person)**

infection may be caused by a microorganism acquired from another person in the hospital and transmitted:

- through **direct contact** between patients (contaminated hands)
- through **indirect contact**:
  - via staff contaminated through patient care (contaminated hands, clothes)
  - via objects contaminated by the patient (including equipment)
- in the air (contaminated droplets or dust)



# Routes of transmission

- **exogenous environmental infection**

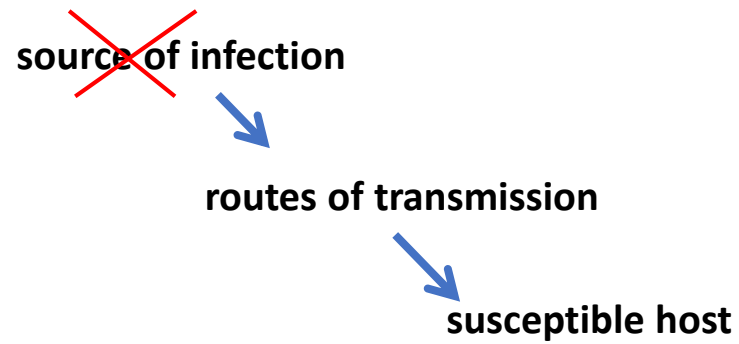
several types of microorganisms survive well in the hospital environment:

- in water, damp areas, and occasionally in sterile products or disinfectants
- in food
- in fine dust and droplet nuclei generated by coughing or speaking
- in items such as linen, equipment and supplies used in care

# Susceptible host

Differential NI risk by patient and interventions:

Risk of infection	Type of patients	Type of procedures
<b>Minimal</b>	Not immunocompromised; no significant underlying disease	Non-invasive No exposure to biological fluids
<b>Medium</b>	Patients with some risk factors ( <b>age</b> , chronic disease, neoplasm...)	<b>Invasive</b> non-surgical procedure (e.g. peripheral venous catheter, introduction of urinary catheter)  Long-term hospital stay
<b>High</b>	Severely immunocompromised patients, ( $<500$ WBC /ml); multiple trauma, severe burns, organ transplant	Surgery or High-risk invasive procedures (e.g. central venous catheter, endotracheal intubation)

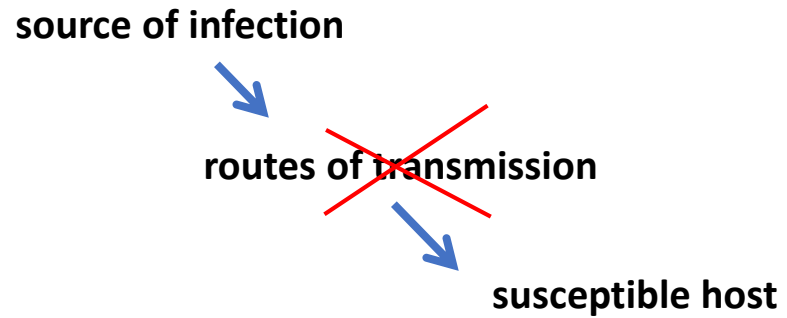


## Control and prevention of HAI

### elimination of the source

- patients (microbiological monitoring at admission, **isolation**, treatment)
- staff (vaccination – VHB, influenza)
- visitors (guidance, restriction in some wards)

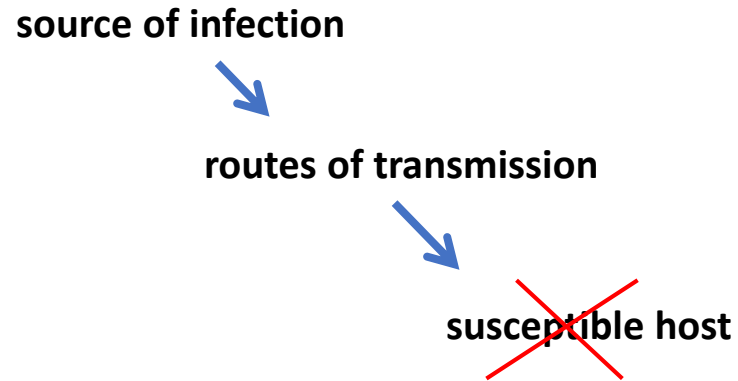
## Control and prevention of HAI



### measures limiting transmission

- **hand hygiene**
- **barrier treatment technique** (e.g. caps, masks, gloves, gowns, dedicated shoes)
- adequate level of **disinfection and sterilization**
- use of disposable material
- continuing staff education - guidelines
- controlling environmental risks for infection

# Control and prevention of HAI



## measures to protect the patient

- risk evaluation – medium risk/high risk patient
- isolation
- appropriate use of prophylactic antibiotics, nutrition, vaccination